AGRICULTURAL Research

MAY 1957

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UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL
Research

Vol. 5—May 1957—No. 11

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Giants

To the list of giants who gave USDA its reputation through the years must be added the names of two men who recently retired: George M. Darrow and Henry A. Jones.

Dr. Darrow was the founder of small-fruits research in USDA and served the Department half a century. Originating good regional strawberry varieties and helping to make possible commercial production of blueberries through cross-breeding and selection of wild varieties brought him recognition as the country's foremost authority in this field.

Dr. Darrow is credited with development, through his own efforts and in cooperation with State and industry plant breeders, of 23 varieties of strawberries. Ten are commercially important and one (Blakemore) is now produced on about 30 percent of our commercial acreage. His leadership in developing virus-free strawberries is remaking the industry.

Dr. Jones, leading authority on onion hybridization, spent the last 20 years with USDA. In 1925, while with the University of California at Davis, he discovered in onions a distinctive form of male sterility. He later used this to develop a breeding method that made production of hybrid onions on a commercial scale practicable for the first time.

The method pioneered by Dr. Jones (utilizing cytoplasmic male sterility) is applicable to all types of onions and is also being used for hybrid sorghums, sugarbeets, and field corn. In recent years, he led cooperative work on hybrid spinach varieties that are high yielding and resistant to disease.

The achievements of these two men are alike in many ways. Both have won many honors, including the Department's Distinguished Service Award. The preeminence of each caused fellow workers throughout the country to look to him for leadership. And although a whole industry is already heavily indebted to both, their contributions are only beginning to count—we shall be enjoying the results for years to come.

George M. Darrow and Henry A. Jones fit the tradition of public service that has made USDA world renowned. They stand as an inspiration to the colleagues they left behind, a challenge to those who find careers here in the future.

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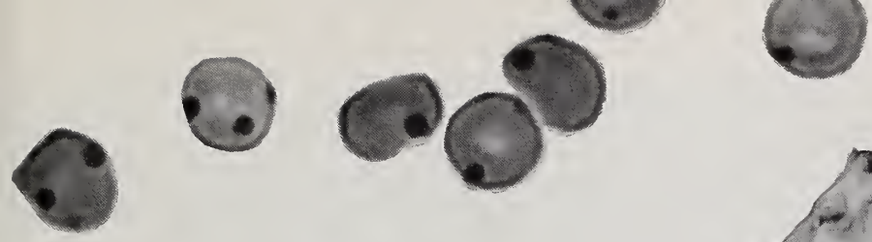

TRIAL RUN AGAINST Anaplasmosis

Encouraging results in Hawaiian eradication test should help us develop control measures

■ WIDESPREAD USE in Hawaii of the Federal-State-developed complement-fixation blood test for anaplasmosis is providing information that will assist in the control and eradication of the disease in this country.

Anaplasmosis is an infectious and serious disease of cattle annually costing livestockmen millions of dollars in losses. When the disease was first discovered in Hawaii in 1954, USDA veterinarians decided on a full-scale control and eradication trial there for several reasons.

First and possibly most important, such an approach would give first-hand information on the field effectiveness of the test (which had already proved its value in diagnosing infected animals). In addition, good control could be kept over introduction and movement of all animals, since there were only 160,000 beef and 15,000 dairy animals on the islands. Last, none of the known-disease-carrying ticks was present. Because of this, a test-and-slaughter plan was considered feasible without a vector-eradication effort. This plan was put into effect in November 1955 by the Territory of Hawaii, working cooperatively with ARS.

Test used in Hawaiian plan

Essentially, the plan consisted of: (1) using the complement-fixation test to detect infected animals; (2) identifying and slaughtering animals that reacted positively; (3) paying an indemnity to owners for animals removed for slaughter; (4) testing Hawaiian herds and imported animals (including all those over 2 months of age) at not less than 60-day intervals until 2 successive negative herd tests were obtained; and (5) testing blood samples from all cattle slaughtered in the Territory.

Progress toward eradication of anaplasmosis in Hawaii is very encouraging. ARS officials feel that experience gained there will assist in developing practical control measures in the United States.

Current control measures in this country vary, depending on location of the outbreak, extent of infection in the herd, and local and State authorities. In Ohio and Washington, for example, herds are quarantined and infected animals are slaughtered.

Warm climate favors disease

The disease occurs the world over but is especially common in warmer climates and in warmer months. In this country, it is most prevalent throughout the South and parts of the West and Northwest. At least 17 States consider it a major problem.

What is the nature of this puzzling disease? Anaplasmosis is caused by minute, one-celled protozoa—*Anaplasma marginale*. These protozoa are similar in some respects to those that cause malaria. No practical method for treatment or immunization exists, although blood transfusions and antibiotics are somewhat beneficial in treating sick animals. The disease is especially severe in mature cattle—is marked by anemia, fever, and microscopic parasites in red blood cells (see pictures).

Organism easily transmitted

An extraordinary feature of anaplasmosis is the ease with which it's transmitted *mechanically* by surgical instruments and some insects, and *biologically* by so many ticks.

Many cases of anaplasmosis have followed after dehorning, for example, when dehorning instruments were not properly disinfected. It is essential that separate and sterile needles be used for vaccinations or for collecting blood samples, to prevent accidental transmission within the infected herd. Disease control is further complicated by the difficulty in checking so many known and potential vectors. Widespread spraying and insecticides are helpful.

Much work is currently being done by ARS researchers on life cycles, physiology, and habits of these ticks and flies. Knowledge thus gained could help in breaking the life cycles of these disease carriers and open another door to possible control.☆

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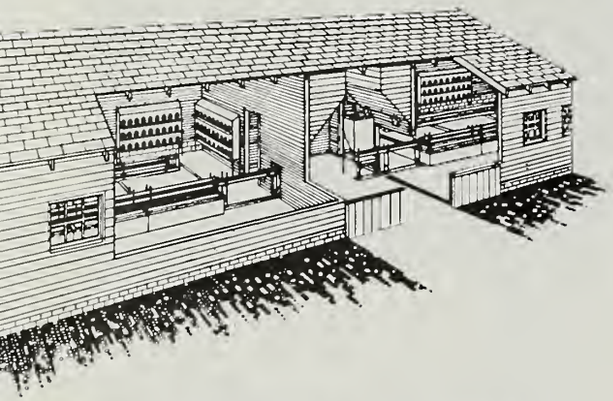
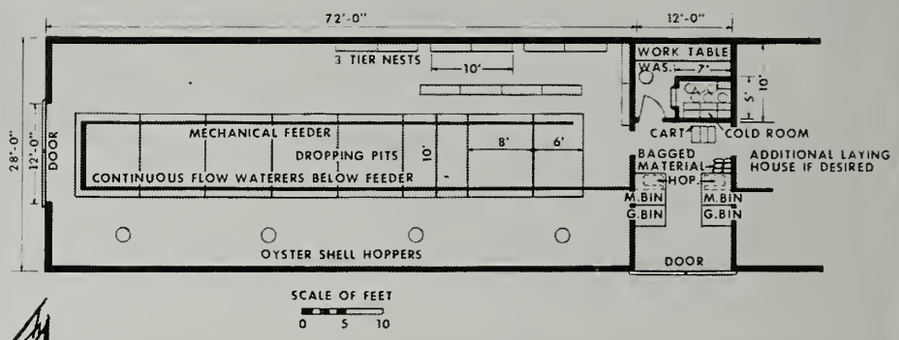




FLEXIBLE PLAN above is 1 of 7 suggested for laying houses. The blueprints range from completely mechanized to all-hand methods.

LESS LABOR ON LAYERS

Researchers find answers in flock size, equipment use, and house arrangement

■ TIME SPENT ON poultry chores over a period of a year may be reduced by 80 percent. Cooperative studies by USDA and the Illinois Agricultural Experiment Station show that efficient producers work 30 to 40 hours per 100 layers instead of 250 hours (Illinois average) annually.

ARS agricultural economist R. N. Van Arsdall and agricultural engineer Thayer Cleaver studied flocks of 300 to 2,500 hens on 35 Illinois farms. Time-saving devices included increasing size of flocks, adding machinery and equipment, and arranging poultry buildings and equipment to decrease labor needs. Seven plans are outlined by researchers in a circular published by the Illinois station.

Laying houses should be designed to facilitate good management practices and effective use of labor and equipment. Only highly specialized farms can justify facilities designed especially for chickens. Egg production on Midwest farms should be planned to fit the whole diversified system of farming. Buildings should be arranged so that adjustments may be made for changes in prices and technology. One-story structures are preferred, but barns may be remodeled into multiple-story houses. General-purpose farm equipment should be used when chores are mechanized.

Flock size is the chief factor in determining time and investment requirements. Economic feasibility of handling less than 500 hens is questionable, with labor at 90 cents an hour and interest at 5 percent. Smaller flocks are profitable only if unused labor and buildings are available. Large flocks cut labor, make it easier to use mechanical equipment.

Cleaning and culling are eased

Researchers found that placing perches and dropping pits in the center of the laying houses eases use of tractor equipment for removing manure and simplifies culling. Placing waterers and feeders over dropping pits helps keep litter clean and dry.

Mechanical feeders cost more than troughs or drum feeders but greatly reduce labor. Flocks of 700 hens are necessary to justify a shift from feeding by hand in trough feeders to using mechanical feeders, with labor at 90 cents an hour and interest at 5 percent. Not more than 1,500 hens should be placed together in one laying pen.

Feeding, watering time cut

Mash ration handled in bulk form with mechanical equipment takes the least time, although most poultrymen like to use farm-produced grain. Weekly filling of self-feeders with a complete ration is quicker than 4 feedings of 5 kinds of feed each day.

Arrangements for a convenient place for storing feed are essential to reduce work. This, say researchers, is one of the easiest facilities to provide, yet the most often neglected. If hens are fed by hand there should be storage within the laying house, preferably at one end if there are 500 to 600 hens. For larger flocks, storage should be centrally located. When mechanical feeders are used, location of feed storage is less important.

Hoppered bins or feed rooms should open into the house. Drive-in or other access from the outside should be provided. An elevator, blower, or auger may be available for overhead bins. Chutes may lead to lower floors in multiple-story houses.

Carrying water by hand is the most difficult and time-consuming job in egg production. One automatic waterer providing a continuous flow of water for every 150 hens is the least expensive method, even in small flocks. Feeding and watering account for about one-third of the chore work on laying flocks (42 hours by hand annually per 100 hens) and may be reduced to 3 hours with mechanical equipment in large operations.

Light, ventilation required

There should be a daily average of 13 to 14 hours of light in a laying house. One 60-watt bulb 7 feet above the floor is recommended for every 200 square feet of floor space. Proper ventilation should carry off excess moisture, provide fresh air.

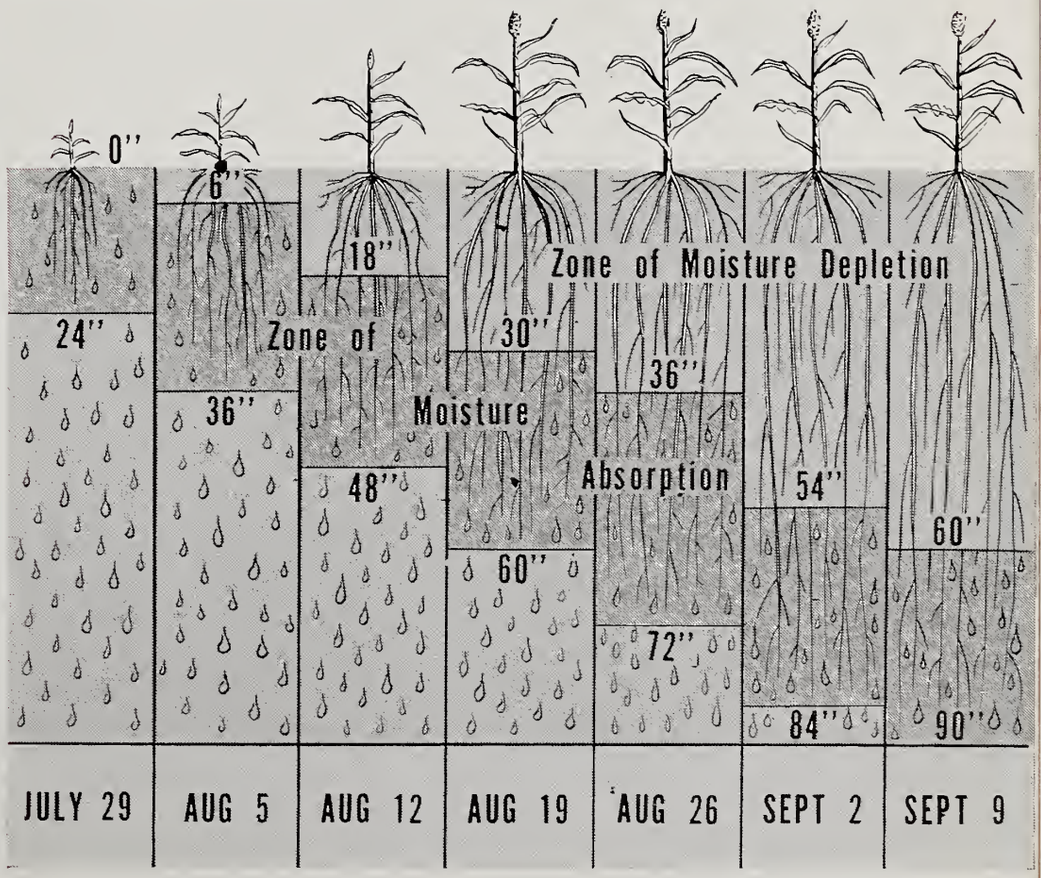
Nests may be tiered and should be kept along the wall, preferably near the egg room, at heights convenient for gathering. One square foot of nesting space for every 5 hens is a good rule. Litter should be 6 inches thick and of good material to reduce soiling and breaking of eggs. Darkening nest areas encourages use.

Eggs should be gathered from the far end toward the egg room, a minimum of three times daily, using a convenient place to set wire baskets. Machines for cleaning eggs are one of the greatest labor savers in egg production—most economical for flocks above 300. Mechanical graders are used most effectively when eggs are cleaned by machine instead of hand. Both machines are economical for 500 or more hens. Gathering, cleaning, and grading may be reduced to 40 hours from 100 hours for every 100 hens. ☆

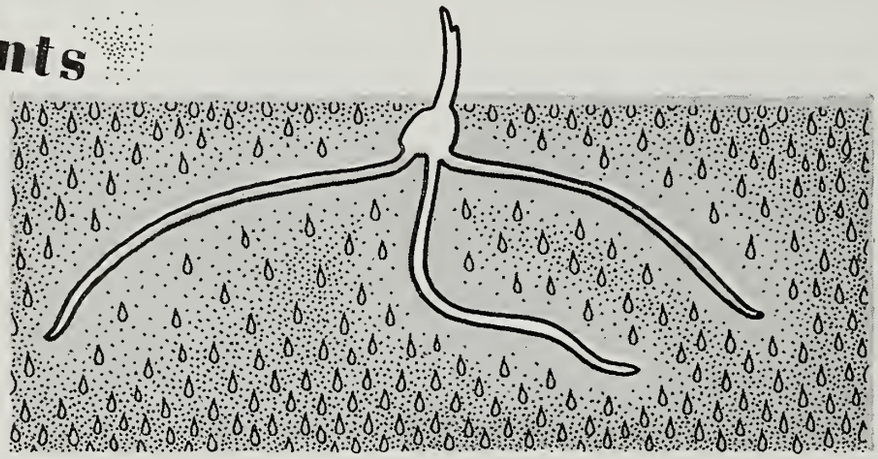
Sorghum GOES FOR STORED WATER

GRAIN SORGHUM CAN yield well with little rainfall during the growing season if the soil holds enough water at planting time. Preseason irrigation or water conservation practices that increase moisture storage go a long way toward assuring good yields in semiarid areas.

In experiments at Fort Hays, Kans., USDA soil scientist P. L. Brown measured yields at 37½ bushels per acre on plots wet at field capacity to a depth of 7 feet at the start of the season but subsequently receiving only 5.3 inches of water (rainfall) during growth. The sorghum developed normally by sending down roots and extracting water at increasingly deeper soil zones as the season progressed, as shown in the illustration. Roots drained each new zone of penetration to the wilting point 2 or 3 weeks and ultimately picked up 16.4 inches of water.☆



SOIL *moisture* . . . CROPS *nutrients*



New knowledge of this complex relationship points way to better management of water and fertilizer

■ Soil moisture tension (the tenacity with which water clings to soil particles) has been widely accepted as the controlling factor in a crop's ability to get water. But studies now show that tension also profoundly influences *nutrient uptake* and that water *content* of a soil is an important additional factor in availability of both water and nutrients.

A thorough understanding of these principles developed through USDA-State research should open the way to much better integration of water and fertilizer management than we've been practicing in the humid East as well as in the irrigation areas.

Tension, content are varied

ARS soil scientist D. B. Peters, working cooperatively with the Illinois Agricultural Experiment Station, compared root growths in soils at various moisture contents and various moisture tensions. When there was no difference in moisture content, tension regulated the amount of root growth. But among soils at the same tension, soils with the greater moisture gave the greater root growth. In this case, soils of higher clay content held greater amounts of water.

Water flow controls growth

When water is extracted by the root, more water must flow to the root from the soil mass before further extraction can occur. The movement of replacement water largely determines how fast plants can take up water and grow. The soil's capacity to hold water and to transport it determines the distance over which roots may obtain water. The rate at which a new supply moves in is determined by both soil moisture tension and by the ability of soil to conduct water. The ability of soil to conduct water is influenced by soil water content. Therefore, both the tension and the content are important.

Peters also made preliminary studies of the effects of soil moisture tension and soil moisture content on nutrient absorption by plants. He added various amounts of radioactive rubidium to soils of different textures and, with the aid of a Geiger counter, measured the amount of rubidium taken into corn roots.

Contrary to expectation, the total volume of nutrients in the soil did *not* determine how much nutrients would be taken up. Instead, the root got more nutrients as the nutrient solution in the soil became more concentrated. Stated another way, at any one moisture tension, the *lower the moisture content* (due, for example to greater soil coarseness), the *richer the nutrient solution* and the *greater the nutrient uptake.* That is consistent with the method of nutrient absorption through exchange of ions between a root and the soil.

Nutrient transport is factor

But when the nutrient solution was enriched by adding more nutrients (rather than by increasing tension through reducing soil moisture) a new factor entered the picture. Increasing the amount of nutrients per unit of soil brought about a gain in the nutrient uptake—a disproportionately large gain compared with the amount of nutrient applied. This showed that the plant's nutrition was influenced by some factor in addition to the nutrient applications—probably a transport phenomenon.

After the initial increase in rubidium uptake as wet soil (soil in the low-tension range) dried out, there was a gradual decrease in rubidium uptake while tension further increased. Peters thinks this could be caused by (1) reduced diffusion of the nutrient within the moisture next to the root, where extraction occurs; and (2) by a lag in mass flow of nutrient-laden moisture through the soil to the root as water is locally depleted—especially the latter.

The study further showed that in a drying soil, as moisture tension rises, nutrient starvation sets in before water starvation does. Apparently, nutrient transfer is more drastically affected than water flow. ☆

boll weevils GET TOUGH

We are meeting insecticide resistance by seeking new chemicals and new approaches

WAYS TO CONTROL the boll weevil, now resistant to chlorinated hydrocarbons in some areas, are being sought by USDA and State scientists in both basic and applied research.

The ARS Cotton Insect Research Laboratory at Baton Rouge, La., is cooperating with the Louisiana Agricultural Experiment Station in a basic approach. At the same time, ARS and other State experiment stations are keeping one step ahead of the insect—with new insecticides to replace chemicals no longer effective.

Time was when the chlorinated hydrocarbons were generally effective against all boll weevils. But in 1955, entomologists found the insect had developed resistance to these insecticides in some sections of Louisiana, the southern delta of Mississippi, and parts of southern Arkansas.

The resistance was carried over in weevils that emerged from hibernation in 1956, with considerable spreading in Louisiana and some increases in Mississippi and Arkansas. Resistance also occurred on a few farms in one county in Texas and on one farm in South Carolina. Endrin was ineffective on the South Carolina farm following 14 applications.

Shift of chemicals effective

Although the boll weevil showed resistance to chlorinated hydrocarbons in 1956 in some local areas, control of resistant weevils was obtained with calcium arsenate and certain phosphorous insecticides—methyl parathion, malathion, and EPN. The chlorinated hydrocarbons were still used effectively in all areas of the boll-weevil belt where resistance had not yet been encountered.

Last December, entomologists recommended use of a new phosphate—Guthion. Tests are already underway at Baton Rouge in cooperation with the Louisiana station to determine how long it takes boll weevils to become resistant to Guthion.

At the same time, work is also in progress on locating still other insecticides—in preparation for the possible day when this new insecticide may no longer be effective. Much screening of new insecticides is conducted at the Texas Agricultural Experiment Station, College Station.

New control approach sought

Scientists believe this search for new and more powerful insecticides may be only a stopgap until a new and better approach is found through more basic research. Special efforts are underway at College Station to discover effective insecticides that the boll weevil cannot overcome—that is, chemicals with modes of action different from chlorinated hydrocarbons and phosphates. Ways to block or reverse resistance are also under investigation at Baton Rouge.

The advent of toxaphane and BHC in 1946 and 1947, and later of aldrin, dieldrin, endrin and heptochlor, was a milestone in the control of boll weevils. Development of low-gallonage, low-pressure sprayers represented another milestone. And a new early-season insecticide timing schedule provided more ammunition against cotton insects in many areas.

Insects continue to threaten

Some $50 million worth of insecticides are purchased annually to control cotton insects, and another $20 million is spent to apply them.

Cultural practices play an important part in reducing insects. Early destruction of stalks in southern Texas helps control the boll weevil and pink bollworm the next season.

These developments still do not prevent heavy losses from insects in some areas. As potential per-acre yields increase, so do the insect problems. Cotton is grown today on improved land that's producing more luscious plants, more attractive to insects over a longer period of time.

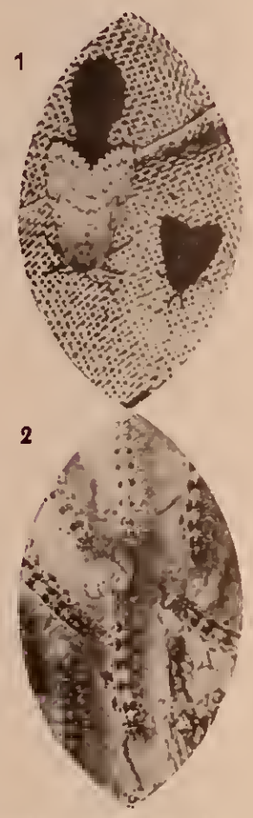
Farmers have become more insect conscious and realize the need for more effective tools. Entomologists are racing to find new ways to help cotton growers fight the battle.☆

BOLL WEEVIL TESTS at Brownsville, Texas, showed 27.3 percent infestation following Guthion treatment (foreground). Nontreated areas had 63.5 percent infestation (background).

PUSHING BACK THE GYPSY MOTH

An all-out effort to clean up fringe outbreaks is the highlight of our 1957 eradication campaign against this forestland enemy. Operations are based on research-developed equipment techniques

EGG CLUSTERS laid last July by the *Porthetria dispar* gypsy moth (the large white moth covering eggs with a silk-like substance in photo 1 is the female) are now hatching as caterpillars (2). Larvae, which feed on leaves and defoliate trees (below), change to pupae in late June or July. Moths emerge to lay eggs on trunks, under bark and leaves. Shaded section on the map represents the generally infested area. Black portions show area sprayed by USDA and State.



A $5 MILLION WAR against the gypsy moth has been launched in 9 Northeastern States, where 38 million acres of forest land are infested.

USDA and State workers will spend more than half the funds on eradication of the insect from border areas of the infestation in New York, New Jersey, and Pennsylvania to prevent further spreading south and west. States will continue spraying to prevent widespread damage in the generally infested area of New England.

The larvae, 2 to 3 inches long, feed chiefly on the leaves of hardwood trees, destroying several million dollars worth of timber annually.

Trees are defoliated and fire and erosion hazards are increased. Weed trees are reproduced more rapidly. The defoliated trees that die lower the ability of these forests to hold back flash floods. This means lowering the water table of farms.

Each acre of forest land in the border area is being sprayed with a pound of DDT mixed with a gallon of light oil. This includes 410,000 acres in New Jersey and Pennsylvania, and 2,540,000 in New York, a total of almost 3 million acres in the area.

Spraying depends on weather

Normally, the spraying starts about April 15 and extends to about June 20. The exact date depends on weather conditions. If there is a late spring, larvae will not emerge as rapidly from the eggs, causing a delay in starting the spray program.

Many blimp-like 8-foot-long balloons are used as markers for pilots to avoid spraying over reservoirs, fish ponds, mink ranches, and dairy and chicken farms. The balloons, attached to stakes in the ground, are raised and lowered on reels recently developed by researchers.

Surveys were made in February to determine kind and number of aircraft needed. Multi-engine planes flying according to Federal and State regulations are used over congested areas. Both large and small planes are used over forestlands at altitudes of 100 to 150 feet. Aerial spraying is done by private operators under contract to the Government.

Plant pest control specialists have developed equipment to control spraying pattern as well as droplet size. And Forest Service researchers have developed oil-sensitized 4-by-5 cards that are placed at 20-foot intervals along the ground to record spray patterns. If an area has been properly covered with DDT, the test cards will be freckled with numerous drops.

Coverage to be well checked

Sections where cards are inadequately covered will be resprayed. The area to be treated in the 3 States is divided into 6 units. Pilots in observation planes in each of the units keep in radio contact with the airstrip supervisors and ground observers. Pilots check for proper height, proper spaying patterns, and failure to spray in the designated eradication areas.

Surveys will guide in mopup

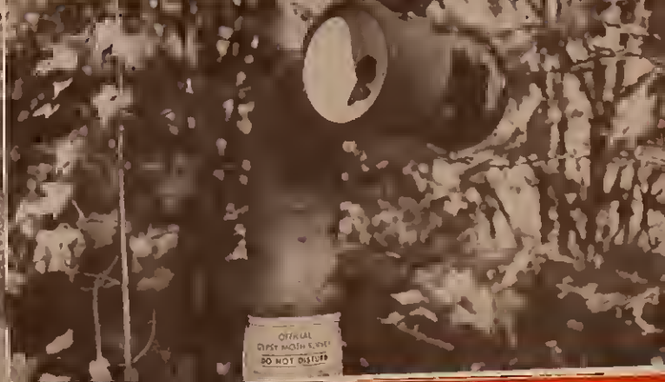
Sections sprayed last year are now under control except for a few isolated spots. At the end of the summer, checks will be made on the effect of this year's spraying. Surveys are conducted through use of traps that are baited with attractants taken from the body of the female moth. Male moths that survive are lured to the traps, which contain a sticky paper as well as the aromatic attractant.

Mopup operations will be necessary for complete eradication of the pest in such a large spray area.☆

PLANES SPRAY FRINGE AREAS with DDT to kill the larvae and to prevent spreading of the insect, particularly by wind. Infested areas also are pushed back. These gypsy moths date back to caterpillars that escaped from a French scientist's laboratory in Medford, Mass., 1869. (Photo taken prior to contract operations.)

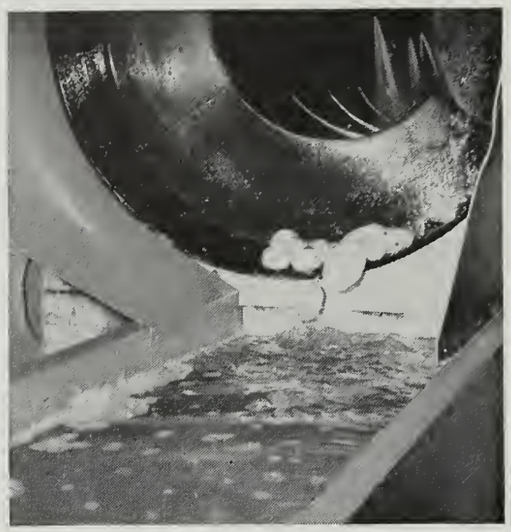
BLIMP-SHAPED BALLOONS are raised to warn pilots not to spray over water reservoirs, dairy, poultry or mink farms. These balloons—8 feet long, 3 feet in diameter—also mark boundaries for spraying. About 3 million acres of the 38 million infested acres, are along the border.

ATTRACTANT-BAITED TRAPS helped locate infested areas for planning the spray program. (The lure comes from the body of the female gypsy moth.) Mopup operations will be necessary at the end of the summer if any insects are located by use of some 40,000 traps.



Cheaper, Better Prepeeled Potatoes

LYE-PEELED potatoes emerge from a drum into neutralizing solution. Cold water jets in drum actually remove the skins, loosened by prior immersion of potatoes in lye bath.



A fast expanding business needs better methods for processing, packaging, storing its products

■ POTATOES—OUR LARGEST vegetable crop—are finding a place in the parade of convenience foods. For restaurants and other food-service operators, commercially prepeeling and precutting save tedium and costs.

Commercial prepeelers, however, need faster, cheaper, and more efficient ways to peel tons of potatoes per hour, refrigerate and package them, and supply them to customers. Helping to do this is USDA research.

Successful prepeeling operations depend first on selection of good potatoes. For example, low sugar content is needed for french fries, mealiness for mashing, and freedom from sloughing for boiling or salads.

Potatoes are then peeled, treated with sodium bisulfite or sulfur dioxide to prevent discoloration, refrigerated to avoid bacterial spoilage.

Lye-peeling proves efficient

Lye-peeling at low temperatures (below 160° F.) reduced peeling loss and trimming labor, according to ARS scientists at the Western Utilization Research and Development Division, Albany, Calif. This type of peeling utilizes the caustic and heating effect of lye to soften the skin, and prompt washing to remove both the skin and lye adhering to it. The process results in the same depth of peeling regardless of tuber shape.

Cool storage lengthens life

Perishability of prepeeled potatoes is comparable to that of meat and milk; storage at 40° F. or below is required to prevent potatoes from spoiling. Spoilage eventually results even under refrigeration, but storage life can be extended to 7 or 10 days by maintaining high sanitary levels to prevent undue contamination.

Researchers point out that cooling prepeeled potatoes before they are packaged is an effective way to minimize spoiling. This was done by refrigerating the sodium bisulfite treating solution to 34° F. The temperature of french-fry cuts was thereby reduced to 40° F. or below and that of whole peeled potatoes to about 50° F. At a storage temperature of about 50° F., however, adequate air circulation is necessary to keep whole peeled potatoes from spoiling.

Cooling the packaged product in a refrigerator is slow and uneven.

Processors of prepeeled potatoes are continually faced with the problem of buying potatoes that will french-fry to the desired light color. A hot-water blanch before frying reduced french-fry color, researchers found. Five-minute leaching in hot water (160° F.) and a 1-minute dip in the treating solution produced very light colored french fries.

Undersized cuts can be used

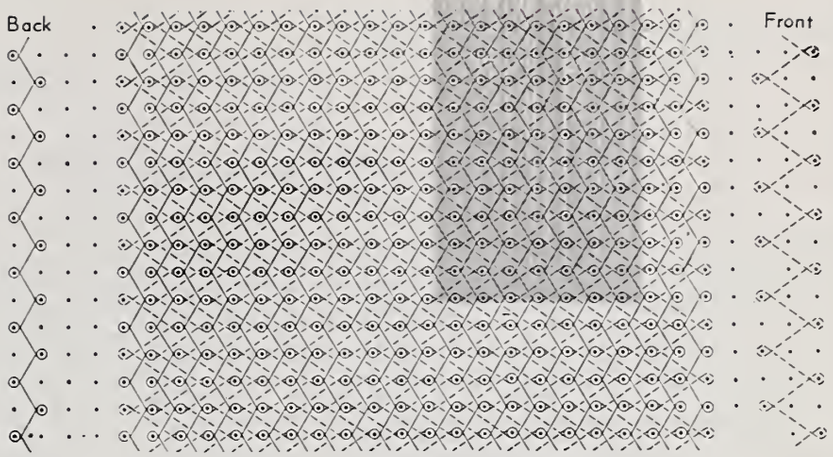
Preparation of hash-brown stock is increasing efficiency of operation as well as service to customers in the prepeeling industry. In laboratory experiments on hash-brown stock, small, whole peeled potatoes were cooked, cooled, shredded, and combined with shreds made from undersized cuts from the french-fry cutter. A ratio of 2 parts of shreds from whole tubers to 1 from the undersized cuts is necessary for good frying.

Potato prepeeling by centrally located processors offers a fairly new but rapidly expanding service. A recent study made by the Agricultural Marketing Service shows that prepeeled potatoes have gained over 50 percent in volume within the past 2 years. (Average quantity of potatoes peeled per plant in this country is about 40,000 pounds a week.)

Growth of the industry is likely to continue. One reason is the gap between prepeeled potatoes sold—about 5 million bushels annually—and total consumption in restaurants and other eating establishments—about 65 million bushels a year. Another reason is the large potential posed by retail sales, a market that processors are just beginning to explore.☆

MAKING A GOOD KNIT FABRIC

Qualities of 2-bar tricot depend not only on size of yarn but also on the construction of the fabric



FREQUENTLY USED pattern of knitting is the 2-bar tricot. Path of front runner yarn is shown in detail at right; of back runner at left. Length of front runner divided by length of back runner yarn is runner ratio.

■ FABRIC CONSTRUCTION (or geometry, as researchers call it) determines certain qualities of knit fabrics. The number of stitches or loops per inch, the size of the yarn, and the ratio between the length of the two sets of yarns used in making tricot fabrics affect their wearing quality and their shrinkage behavior.

Textile physicists Hazel M. Fletcher and S. Helen Roberts in the ARS Home Economics Institute found these relationships, using 97 fabrics of 2-bar tricot knit under controlled conditions at a commercial mill.

Tricot is the correct name for much of the so-called jersey fabric on the retail market. Such fabric is widely used for dresses, underwear, shirts, and blouses—being easy to launder and comfortable to wear.

These tricot fabrics have two sets of warp yarns that are looped through each other during knitting. The yarns, or runners, are of different lengths because each follows a different path. The relation between their lengths is called runner ratio.

Many variables investigated

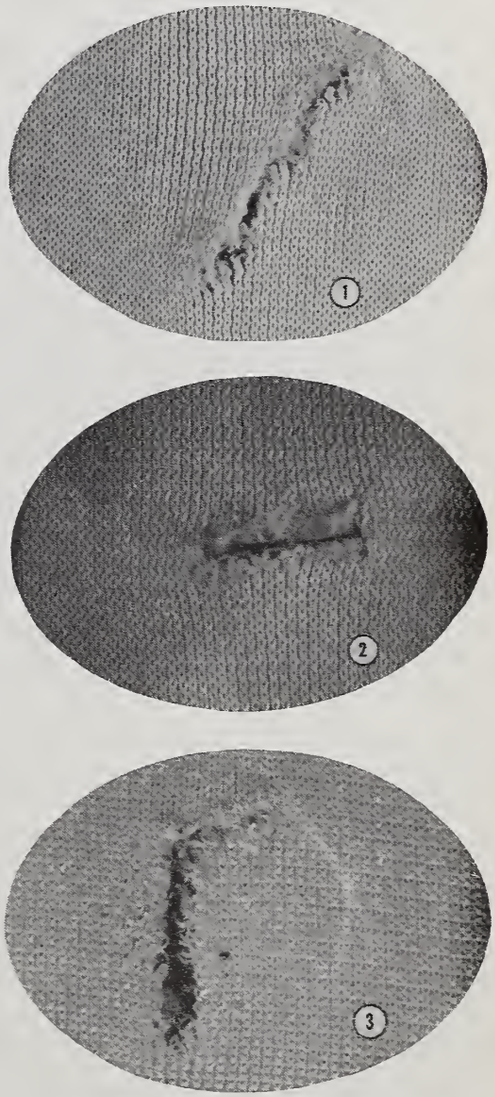
The experimental fabrics used were knit of acetate or viscose yarns of different deniers (size). The number of loops per inch and the runner ratios were varied. For each fabric, researchers determined stitch length, breaking and bursting strength, elongation, and laundering effect on shrinkage and stretching.

Fabrics were stronger both lengthwise and crosswise when closely knit and when runner ratio was low—yarns nearly the same length (11/10, 6/5, and 5/4). Acetate fabrics of 75 denier yarns with low ratios withstood more force (some as much as 69.5 pounds) because the strain fell on both yarns about equally. When a low-ratio fabric did rupture, it burst diagonally across the wales (lengthwise ribs). High-runner-ratio fabrics (7/5, 3/2, 8/5), on the other hand, ruptured with as little as 52.5 pounds. The breaks occurred along the wales or at a right angle to them.

For a specific runner ratio, 150-denier yarn produced fabrics about twice as strong as those from 50- and 75-denier yarn, researchers found.

Fabrics holds shape and size

Shrinkage or stretching of fabric during laundering was due to changes in the shapes of the knitted loops, as in earlier studies on plain-kit fabrics of cotton and other fibers (AGR. RES., November 1953, p. 13). Since fabrics are pulled lengthwise during knitting and finishing, they often have very long, narrow loops. The researchers removed distortion by soaking and manual manipulation to relax the fabric. This enabled the loops to assume their natural height and width. With a stable relationship between width and length, fabric retained its size and shape even after undergoing repeated laundering. ☆



RUNNER RATIO influences fabric strength. Low-ratio fabrics were stronger—withstood more force before rupturing. They burst at angle to wales (1). High-ratio fabrics burst parallel or perpendicular to wales (2, 3).

How're we doing - NUTRITIONWISE ?

Survey reveals weaks spots—but much improvement over conditions found in 1936

Too LITTLE MILK and fruits and vegetables are responsible for most of the weak spots in this country's diets today. Food economists in the USDA Home Economics Institute drew this conclusion after calculating the number of calories and amounts of eight nutrients in the foods reported in the 1955 Household Food Consumption Survey.

On the average, sufficient foods were brought into household kitchens to provide more than recommended allowances of the nutrients studied. But not all households came up to these recommendations for all nutrients. About 3 in 10 households had less calcium and 1 in 4 less ascorbic acid than recommended by the National Research Council. Vitamin A, riboflavin, thiamine, iron, protein, and niacin were short in some cases.

This is a considerable improvement over conditions in 1936, when a large-scale survey showed that one-third of the diets were "poor." Today, probably as few as 1 in 10 of the households in this country have a poor diet by the 1936 standards.

Enriching flour, grain helps

Much of the improvement since 1936 is due to the greatly increased consumption of the three B vitamins—riboflavin, niacin, and thiamine. People are now getting more of these nutrients because of enriched grain products, especially in low-cost diets. Enrichment of flour and bread is required in 27 States; even where it's not required most of the bread and flour from wheat are voluntary enriched. Cornmeal and grits must be enriched in some States.

Greater use of milk and meat—made possible by favorable economic conditions—is also responsible for more niacin and riboflavin as well as calcium and protein in diets. Calcium (obtained from milk) has not increased enough and is the nutrient most often short in today's diets.

Higher average real income, benefiting especially families at the lower end of the income distribution, enables an increasing number of people to have the foods they want. And new processing, transportation, and marketing practices make available a great variety of foods in convenient form, even in remote villages.

Education betters our diets

It's fair to say education also has a part in today's better eating habits, although its effect has not been fully measured. School teachers, physicians, nurses, extension workers, and other educators, working individually or through nutrition committees (AGR. RES., December 1956, p. 14). spread information about nutrition

HOW MANY UNITED STATES FAMILIES GET RECOMMENDED AMOUNTS OF THESE KEY NUTRIENTS ?

and guide people to choose foods that supply needed nutrients.

The 1955 survey shows that as income rises, urban and rural nonfarm families choose foods that supply larger quantities of nearly all nutrients. Vitamin C, especially, is closely related to money available—higher income families use more fresh fruits and fruit juices rich in this factor. Calories are least affected; all groups use about the same.

In farm homes, on the other hand, income has little effect on nutrients other than vitamin C, and farm families have more than city families of all nutrients except ascorbic acid and vitamin A. These two nutrients, found in dark green and deep yellow vegetables (vitamin A) and citrus fruits (vitamin C), are used in smaller quantities by farm than by city families. Home-produced food contributes to farm diets at least 30 percent of the nutrients studied; for vitamin A, calcium, and riboflavin, the contribution rises to 50 percent.

Fat is large calorie source

A special calculation was made of total fat (visible and invisible) in foods brought into kitchens. Today's farm families have 170 grams (6.2 ounces) and nonfarm families 153 grams (5.4 ounces) of fat available per person every day. (No record was kept of food discarded; most likely, some fat was not eaten.) These amounts provide 44 percent of the calories of all households. In 1936, only 38 percent came from fat. Whether the shifts in calorie source—more from fat, less from carbohydrates—is or is not nutritionally desirable needs further research.☆

HOLLY WITH A FUTURE

AN EXCEPTIONALLY FINE Chinese holly shrub introduced to this country by USDA 49 years ago is highly esteemed by horticulturists and holly fanciers, but it has failed to "catch on" with the trade.

It's the species *Ilex cornuta*, from which several distinct types of some merit have been selected. A decidedly superior one for landscaping is the variety Rotunda (not to be confused with the holly species *I. rotunda*). The other types may be useful in breeding work.

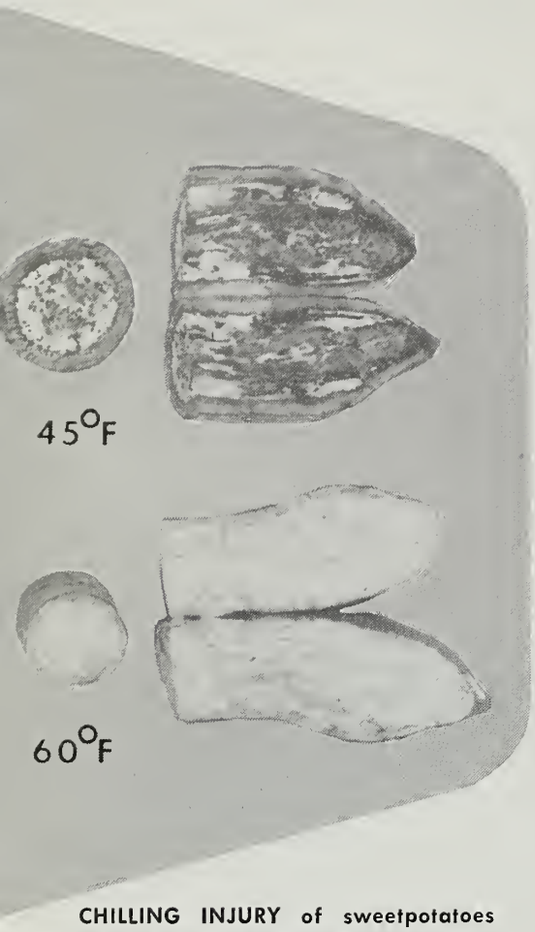
Rotunda is compact, globe-shabed, broader than tall, and has dark, glistening leaves. It takes several years to reach 3½ to 5 feet. It is

excellent for its foliage contrast and for facing down other plants. With limited training, it becomes a low hedge plant. Although it doesn't produce berries, beauty of color and form make up for that.

ARS horticulturist H. H. Fisher, Beltsville, Md., thinks Rotunda will be popular when landscape gardeners see it. It is hardy where the common Chinese holly grows well—the eastern coastal plain from Baltimore southward through the Carolinas and along the West Coast.

This and some berry-producing plants—one with yellow berries and two with red ones—were found in a southern planting of seeds USDA obtained in China in the 1920's. A plant brought from eastern China in June 1908 by explorer F. N. Meyer was the first introduction.

A few nurseries have limited supplies of Rotunda variety. Demand might exceed the supply, but the nurserymen should be able to build up sufficient stocks within a few years to satisfy all of the needs.☆



CHILLING INJURY of sweetpotatoes is detected after storage at 45° for 16 weeks. Potatoes stored at 60° during the same time show no injury.

CRACKING PLANT CELLS

Study of basic cell particles may lead to improvements in fruit and vegetable marketing

■ DOCTORS HAVE ATTEMPTED to remove the heart from a human and keep the organ beating. Now scientists have isolated and kept "alive" the mitochondria (basic particles of the cell)—which control the breathing process in fruits and vegetables as well as in animals. The purpose: to learn to better preserve produce quality from farm to consumer.

Cells cracked in cold room

USDA scientists use kitchen utensils such as milkshake mixers, potato ricers, and graters to crack open the tisue's cells, each containing some 2,000 mitochondria. Agricultural Marketing Service researchers wear lamb's-wool-lined jackets and work in rooms at close to freezing.

These basic and applied experiments, being conducted by phsyiologist Morris Lieberman, may indicate two things: (1) the nature of aging and chilling reactions; and (2) how to determine chilling injury.

To isolate the mitochondria in sweetpotatoes, scientists grate the potato, blend the vegetable in a mixer with a sugar solution, and put the mixture through a ricer to separate the liquid. Researchers pour the solution (which contains the mitochondria) in a vial and centrifuge it at 1,000 revolutions per minute, later at 17,500 r. p. m. The mitochondria drop to the bottom of the vial. Then the particles are checked in a respirometer to determine if they are still "alive." Mitochondria from squash, avocado, and red cabbage have also been isolated and kept active. Experiments are under way with other fruits and vegetables.

Most sweetpotato mitochondria become less active when chilled at 45° F., indicating injury by chilling. But when ATP (adenosine triphosphate), a basic energy substance, is added to the injured mitochondria, they seem to be normal for about 6 weeks. After that, regardless of addition of ATP, the injury is evident.

Chemical changes are noted

Chlorogenic acid, normally present in the sweetpotato, increases fivefold and the ascorbic acid decreases drastically after a 6- to 8-week period of chilling at 45° F. Tissues darken and form melanin, caused by oxidation of the chlorogenic acid.

Scientists want to further investigate these reactions to determine whether the same sequence of events that occur in chilling also occur with aging of fruits and vegetables after storage at usual temperatures. The chilling reaction may be similar to the one occurring with age, but is more rapid. Both processes represent deterioration. When chlorogenic acid of high concentration (such as that developing after chilling injury) is added to healthy mitochondria, they deteriorate. But when ascorbic acid is added simultaneously, the mitochondria remain normal.

Ion leak could be test base

In addition to noting this possibility of a similarity between aging and chilling reactions, scientists learned that ions (electrically charged atoms or groups of atoms) leak from the cells when chilled sweetpotato slices are placed in a solution. The amount of electricity conducted by the solution may be measured to determine degree of tissue injury. Basic research is planned on what causes this leakage and what happens before ions ooze out of the cell.

On the basis of such leakage, there may be a possibility of detecting whether fruits and vegetables are closer to spoilage than may be expected by outward appearance. This injury may affect flavor and nutritional value as well as appearance.

Most people know bananas should be kept out of the refrigerator. Perhaps this would also apply to some other fruits and vegetables. Future experiments are planned to check the amount of leakage from slices of different commodities after storage at different temperatures. More information is expected regarding best storage temperatures for maintaining the quality of each kind and variety of fruits and vegetables.☆

Making awnings last

A new chemical treatment developed jointly by USDA and the Canvas Products Association International protects cotton awnings against sunlight and mildew.

In tests at the ARS Southern Utilization Research and Development Division, New Orleans, canvas was treated with 6 percent urea-formaldehyde resin plus copper 8-quinolinolate. This cloth kept up to 92 percent of original breaking strength for 12 months' exposure. Average commercially treated awnings kept only 67 percent of original strength.

Big seeds for range

On the semiarid western plains where millions of acres are impaired by several years' drought, agronomists are wishing they had big-seeded strains of the native range grasses.

USDA research has shown that big seeds in some species, especially sand bluestem, germinate quicker and get established under more difficult conditions than small seeds.

ARS agronomist W. R. Kneebone studied the effects of seed size in sand bluestem, Indiangrass, switchgrass, buffalograss, and side-oats grama at the U. S. Southern Great Plains Field Station, Woodward, Okla. Plantings of sand bluestem from the progeny of 6 large-seeded clones had two-thirds more plants in the stand and produced three times as much forage as did the progeny from 6 selected small-seeded clones. Five of the 6 large-seeded progeny scored higher in plant vigor than any small-seeded progeny, and higher in yield than all but 1 of the latter.

Indiangrass, switchgrass, buffalograss, and side-oats grama varied quite a bit in seed size but promise less through breeding for seed size alone than did sand bluestem.

Environment makes some difference in ability of seedlings to produce large seeds, but Kneebone found seed size is at least partly heritable. Selection and breeding of large-seeded strains of range grasses appear worthwhile.

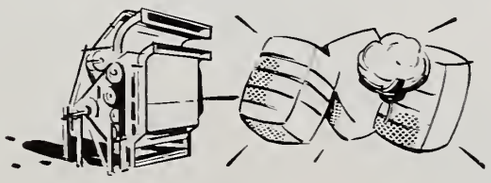
Cotton opener-cleaner

Conversion of the SRRL cotton opener into a productive and efficient machine that will also clean cotton has been accomplished at USDA's Southern Utilization Research and Development Division, New Orleans.

Known as the opener-cleaner, the ARS machine retains features of the opener. It opens baled cotton and blends it with other lots to produce a smoother-spinning lint (AGR. RES., November 1953, p. 3). Although the new machine combines cleaning with opening, it needs less air to operate and also is more productive.

Development of the opener-cleaner is a major step toward improving cotton textile products and in enabling mills to satisfactorily process trashy cottons resulting from machine harvesting or rough hand picking.

In tests on 5 widely grown commercial cottons, the experimental pilot-plant machine averaged 35 percent cleaning efficiency and 0.3 percent lint loss, cleaning 1,500 pounds an hour.



Cleaning efficiency ranged from 24 percent for low-trash cotton to 43 percent for high-trash cotton.

In comparison, conventional cleaners give 10 to 30 percent cleaning efficiency and 0.5 to 2 percent lint loss, cleaning 800 to 1,000 pounds of cotton an hour. These cleaners blend little or no cotton.

It is estimated that the opener-cleaner will save about 0.5 percent of the lint usually discarded as waste. On this basis, 2.5 pounds of usable fiber—worth 75 to 80 cents—would be saved for every 500 pounds of cotton processed. This is the equivalent of $700,000 per year for the 9 million cotton bales processed annually by domestic mills. Much remains to be done to adapt the opener-cleaner for practical mill use. But there is every reason to believe this machine will be a real contribution to the industry.

Many insects identified

USDA scientists identified about half a million insects last year for people of varied interests—farmers, gardeners, agricultural workers, students, industrial researchers, and many others. Specimens were sent in many ways—even taped to letters.

A total of 86,055 species were classified during 1956. The requests were handled and the identifications usually made by a staff of 20 under ARS entomologist P. W. Oman. They do their work in laboratories at the National Museum of the Smithsonian Institution in Washington. That institution retains the insect collection under agreement with USDA.

Reports to foreign agencies and individuals totaled 6,101 last year. Considerable correspondence in other languages is handled by translator Ruth O. Erickson in Washington. This includes letters in French, Spanish, and Portuguese. She also translates technical publications from Russian, Czechoslovakian, Dutch,

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Swedish, Slovenian, Turkish, Finnish, Danish, Norwegian, and Hungarian.

States and insular possessions obtained 36,055 identifications, the largest number. That included the

spotted alfalfa aphid, new to 16 States in 1956. ARS regulatory divisions had 16,517 species classifications, including the khapra beetle collected in a survey with the Agricultural Marketing Service and the States. Other Federal agencies submitted 5,049 species; entomologists, 6,230 species; and American individuals generally, 16,734 insects.

Dye resistance put to use

Wool is being given a chance for brighter and more lustrous colors through development by USDA of new dye-resist processes—making decorative patterns on fabrics by treating parts so they *resist* dyeing.

Traditional treatments use waxes or gums for temporary "resists." Another way is to make a pattern by means of fibers that respond differently to the dye used. Wool accepts certain dyes readily and can be blended with other fibers like cotton or synthetics that dye differently.

Wool can also be chemically treated to *decrease* it's affinity for dyes. Researchers at the ARS Western Utilization Research and Development Division, Albany, Calif., have been studying effects of many reagents on the resistance of wool to degradation by acids and alkalies. The isocyanates—used in making foams and plastics—seem especially promising. Treatment with isocyanates also makes the wool highly resistant to the dyes that are normally used to color untreated wool. Commercial interest in this process is growing.

New ornamental trees

Some desirable new ornamental and shade trees, in prospect for home and street planting but not yet in the trade, are being developed in nurseries and botanical gardens.

One of these—a narrow, pyramidal hybrid of red and silver maple—was produced by plant breeders at USDA's National Arboretum, Washington, D. C. Scientists hope it has the good qualities of both parents.

We've gotten a start with some promising new trees through imports from foreign countries, selections from botanical collections, chance seedlings, and chance sports that sometimes develop on a single branch of an otherwise normal tree. From these sources we have some lower-growing maples, a columnar cherry, globe linden, golden sycamore, and a eucommia (a hardy rubber tree).

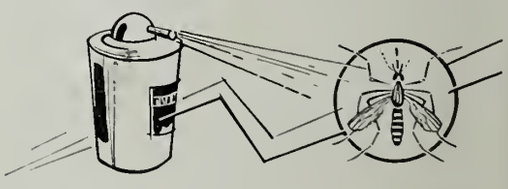
There are only a few specimens of these selections—only a single tree of some. Most of them must be propagated from cuttings or grafting scions, and propagating wood is scarce. It will take several years to increase the stocks and grow them to salable size. But it's worth the wait.

Mosquito vs. insecticide

Mosquitoes are increasing their resistance to insecticides, especially in the West. USDA studies in California show mosquitoes were resistant to DDT in 1949, and to other chlorinated hydrocarbons in 1952.

Entomologists developed malathion, an organic phosphorus compound, as an effective substitute insecticide. Last year, after 2½ years' use, malathion was ineffective against some larvae and adult females.

Tests were made along a 200-mile area from Merced to Kern County in the San Joaquin Valley in 1956 by ARS in cooperation with the Bureau of Vector Control of California State Department of Public Health. *Culex tarsalis* larvae were 20 to 30 times more resistant in Fresno County, where malathion has been



used extensively, than in untreated areas. Also, *C. tarsalis* adults from areas where malathion has been used proved to be about 100 times more resistant than those from areas not treated with malathion.

Research is continuing to develop substitute insecticides for use against the resistant mosquitoes.

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